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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/560,636	12/13/2005	Michael Reinhold Kaus	DE 030208	6806
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EXAMINER				
DRENNAN, BARRY T				
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4133				
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/560,636

Applicant(s)

KAUS ET AL.

Examiner

Barry Drennan

Art Unit

4133

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 December 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 December 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-85/86)
- Paper No(s)/Mail Date 01/22/07.

- 4) ☐ Interview Summary (PTO-413)
- Paper No(s)/Mail Date _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Priority

1. This application claims priority as a national stage application under the Patent Cooperation Treaty, with effective filing date June 7, 2004, and claims foreign priority of application EP 03101750.2, filed with the European Patent Office on July 12, 2003.

Specification

2. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: "Method and device for segmenting time-series images based on adapting a mesh via energy optimization".

3. The specification is objected to, because of the lack of section headings throughout.

The following guidelines illustrate the preferred layout for the specification of a utility application. These guidelines are suggested for the applicant's use.

Arrangement of the Specification

As provided in 37 CFR 1.77(b), the specification of a utility application should include the following sections in order. Each of the lettered items should appear in upper case, without underlining or bold type, as a section heading. If no text follows the section heading, the phrase "Not Applicable" should follow the section heading:

- (a) TITLE OF THE INVENTION.
- (b) CROSS-REFERENCE TO RELATED APPLICATIONS.
- (c) STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT.
- (d) THE NAMES OF THE PARTIES TO A JOINT RESEARCH AGREEMENT.
- (e) INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTED ON A

COMPACT DISC.

(f) BACKGROUND OF THE INVENTION.

(1) Field of the Invention.

(2) Description of Related Art including information disclosed under 37 CFR 1.97 and 1.98.

(g) BRIEF SUMMARY OF THE INVENTION.

(h) BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S).

(i) DETAILED DESCRIPTION OF THE INVENTION.

(j) CLAIM OR CLAIMS (commencing on a separate sheet).

(k) ABSTRACT OF THE DISCLOSURE (commencing on a separate sheet).

(l) SEQUENCE LISTING (See MPEP § 2424 and 37 CFR 1.821-1.825. A "Sequence Listing" is required on paper if the application discloses a nucleotide or amino acid sequence as defined in 37 CFR 1.821(a) and if the required "Sequence Listing" is not submitted as an electronic document on compact disc).

Claim Objections

4. Claims 1, 2, 5, 7, and 8 are objected to because of the following informalities:

The use of the terms "first image" and "second image" is confusing, because when considered by their ordering at the time the images are recorded, the "first image" is taken after the "second image". Appropriate correction is required. Examiner suggests avoiding the use of "first" and "second" altogether, such as by replacing all occurrences of "first image" with "current image" and "second image" with "previous image".

5. Claim 6 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. The phrase, "wherein the method is a method for the automated segmentation in cardiac MRI", is a mere

statement of intended use and is therefore not limiting. The claim makes no other limitations.

Claim Rejections - 35 USC § 101

6. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

7. Claim 8 is rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. Claim 8 claims a computer program, i.e., functional descriptive material, not embodied in a physical manufacture or machine. Functional descriptive material claimed *per se* is nonstatutory; however, functional descriptive material claimed as encoded on a computer readable medium, for example, would be statutory (Lowry, 32 F.3d at 1583-84, 32 USPQ2d at 1035).

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. Claims 1, 2, and 4-8 are rejected under 35 U.S.C. 102(b) as being anticipated by McInerney et al., "A Dynamic Finite Element Surface Model for Segmentation and Tracking in Multidimensional Medical Images with Application to Cardiac 4D Image

Analysis," J. Computerized Medical Imaging and Graphics, Vol. 19(1), pp. 69-83 (1995, hereinafter McInerney).

10. With respect to claim 1, McInerney discloses a method of determining a first segmentation result of an object of interest in a first image of time-series images, the time-series images including the first image and a second image ("We begin by fitting the model to the first volume in the sequence and use this fitted model as the starting point for the reconstruction of the [left ventricle] in the next volume," p. 79);

the method comprising the step of:

adapting an initial mesh to the object in the first image to determine the first segmentation result (*supra*, p. 79);

wherein the adaptation of the initial mesh to the object of interest is performed on the basis of an energy optimisation using the initial mesh and a shape model of the first image ("The deformation energy yields internal elastic forces, and [it] is minimized when these forces equilibrate against externally applied forces and the model stabilizes," p. 71);

wherein the initial mesh corresponds to a second segmentation result of the object of interest in the second image ("We begin by fitting the model to the first volume in the sequence," p. 79);

and wherein the second image precedes the first image in the time-series images ("over successive CT volumes in the cardiac cycle," p. 79; note that the labels

"first" and "second" are generally reversed in time order in the claims compared to the reference).

11. With respect to claim 2, McInerney discloses the method of claim 1, wherein the energy optimisation further comprises the steps of:

determining an internal energy corresponding to a first distance between the first segmentation result and the shape model ("an internal pressure force is used to "inflate" the balloon model towards the object surface," p. 75);

determining an external energy corresponding to a second distance between the object of interest and the first segmentation result ("For example, to attract our model towards significant 3D intensity edges... in some region of an image function..., we construct a 3D potential function [P] whose potential valleys coincide with the object surface," p. 75);

and minimizing the external and internal energies ("The deformation energy yields internal elastic forces, and [it] is minimized when these forces equilibrate against externally applied forces and the model stabilizes," p. 71).

12. With respect to claim 4, McInerney discloses the method of claim 1, wherein the object of interest is at least one of moving and deforming ("We can use the balloon model to estimate the nonrigid motion of the [left ventricle] over successive CT volumes in the cardiac cycle," p. 79; note that the left ventricle both moves and deforms under normal conditions).

13. With respect to claim 5, McInerney discloses the method of claim 1, wherein the second image immediately precedes the first image in the time-series images ("to estimate the nonrigid motion... over successive volumes" and "use this fitted model as the starting point for... the next volume," p. 79).

14. With respect to claim 6, McInerney discloses the method of claim 1, wherein the method is a method for the automated segmentation in cardiac MRI ("CT, MRI, PET, and other noninvasive medical imaging technologies...", p. 1, and "with application to cardiac 4D image analysis," title).

15. With respect to claim 7, McInerney discloses an image processing device ("This section describes an interactive system, implemented on a Silicon Graphics Iris 4D/340 VGX workstation...", p. 76), comprising:

a memory for storing a first and a second image of time-series images (*supra*, implicit);

and an image processor for adapting an initial mesh to an object of interest in the first image to determine a first segmentation result (*supra*, implicit);

wherein the adaptation of the initial mesh to the object of interest is performed on the basis of an energy optimisation using the initial mesh and a shape model of the first image; wherein the initial mesh corresponds to a second segmentation result of the object of interest in the second image (see the rejection of claim 1 above);

and wherein the second image precedes the first image in the time-series images (see the rejection of claim 1 above).

16. With respect to claim 8, McInerney discloses a computer program ("This section describes an interactive system, implemented on a Silicon Graphics Iris 4D/340 VGX workstation...", p. 76) for an image processing device for determining a first segmentation result an object of interest in a first image of time-series images, the time-series images including the first image and a second image, wherein a processor of the image processing device executes the following step when the computer program is executed on the processor:

adapting an initial mesh to the object in the first image to determine the first segmentation result (see the rejection of claim 1 above);

wherein the adaptation of the initial mesh to the object of interest is performed on the basis of an energy optimisation using the initial mesh and a shape model of the first image; wherein the initial mesh corresponds to a second segmentation result of the object of interest in the second image (see the rejection of claim 1 above);

and wherein the second image precedes the first image in the time-series images (see the rejection of claim 1 above).

Claim Rejections - 35 USC § 103

17. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

18. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over McInerney as applied to claim 1 above, and further in view of Hill, et al., "Model-Based Interpretation of 3D Medical Images," 4th British Machine Vision Conference, pp. 339-348 (1993, hereinafter Hill).

19. With respect to claim 3, McInerney describes the use of a time-dependent, three dimensional surface mesh (p. 79), but uses a "balloon" shape to determine the initial mesh at the start of the segmentation process instead of a "training model".

However, Hill describes the use of a genetic algorithm to train a 3D model based on a 3D image (sec. 3.1, 3.2) which could be used to generate an initial mesh for the start of segmentation that is closer to the actual shape than McInerney's initial "balloon" model.

Therefore, it would have been obvious to one ordinarily skilled in the art at the time the invention was made to combine the segmentation technique of McInerney with the initial model training technique of Hill, because doing so reduces the amount of time and user intervention required when fitting the model to the first image in the series (as McInerney teaches, "Once the initial 3D model has been fitted to the first volume, relatively small deformations are needed to fit subsequent volumes; consequently very little user intervention... is necessary. Moreover, the fitting time per volume image should decrease as images are acquired at higher rates because the interframe motion

will be smaller. This should lead to proportionally greater reductions in effort when the technique is applied to future image scanners capable of greater temporal resolution," pp. 79-80).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Barry Drennan whose telephone number is 571-270-7262. The examiner can normally be reached on Monday through Thursday and alternate Fridays from 7:30am to 4:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Abul Azad can be reached on 571-272-7599. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Barry Drennan/
Examiner, Art Unit 4133

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Supervisory Patent Examiner, Art Unit 4133